

The failure of colour

FORTY YEARS ago, in his review of a book that has come to be much admired by historians of prints – W.H. Ivins's *Prints and Visual Communication*¹ – E.H. Gombrich took Ivins to task for overrating the technological and scientific importance of printmaking (i.e. 'exactly repeatable pictorial statements', as Ivins put it).² In the course of doing so, Gombrich raised a crucial issue in the history of the relations between colour and classification. He illustrated this by citing a passage from the Elder Pliny which Ivins had inadequately translated and which Gombrich did not translate at all. The passage comes not, as one might have expected, from the well-known Books 33 to 36 of the *Natural History* on the history and technologies of art, but rather from Book 25, chapter 4, in which Pliny speaks of the first Greeks – Cratevas, Dionysius and Metrodorus – to paint pictures of plants and to write their properties below them: 'Verum et pictura fallax est, coloribus tam numerosis, praesertim in aemulatione naturae, multum degenerat transcribentium fors varia. Praeterea parum est singulas earum aetates pingi, cum quadripertitis varietatibus anni faciem mutant.'³ The passage is indeed difficult to translate, but its sense is clear enough. An adequate rendering would run along these lines: 'But painting is also deceptive, and, with its many colours, is particularly so in the copying of nature, where it also falls short as a result of the varying ability of the copyists. Furthermore, one cannot just paint them [i.e. plants] at individual stages of their life, since they change their appearance according to the fourfold changes of the year.' In glossing this passage, Gombrich alluded, with characteristic suggestiveness, to one of the most fundamental of all taxonomic tensions: the tension between the mutability of natural things, especially plants, and the selection of those characteristics, or *notae* as they were later often to be called, that were – or at least seemed to be – unchanging and unambiguous. Colour failed as a criterion for classification because the portrayal of a plant in colours conveyed its appearance at a particular time, whether of day, year, or a particular stage of its life. It could not convey anything general about the specimen represented. Since colour was neither a permanent nor an essential feature of plants, it could only distract one from those unchanging characteristics that were supposed to define their status as members of particular genera or species. An adequate definition could only be provided by the selection of certain unchanging features of a plant, such as the

reproductive parts chosen by Linnaeus. Gombrich referred to the Linnaean criteria as ones which could be described 'quite unambiguously'.

The point of Gombrich's review was less to draw attention to the failure of colour than to claim that 'after all, illustrations can only be more or less accurate. Only propositions can be true or false, and without this distinction there can be no science.' The issue is moot. It would certainly not have been the view of the great herbalists of the sixteenth and early seventeenth centuries, to whom I here wish to draw attention. Together they mark an important and neglected episode in the history of the relations between colour and classification. Indeed, if Gombrich had decided to pursue the matter of colour further, instead of concluding with his propositional view of science, he would have been able to marshal further instances from quattrocento and cinquecento theories of colour in support of the claim about the non-essential nature of colour. He could certainly have drawn attention to those various passages in Leonardo repeatedly declaring that the surface of any opaque object takes at least some of its hue from the objects surrounding it.⁴ Colour is neither a stable nor an essential characteristic of objects in the world. It can therefore not serve as an adequate basis for classification, let alone as a criterion for distinguishing between natural kinds.⁵ Precisely that which we habitually take to be the most closely and precisely descriptive element of representation, colour, thus fails – at least when it comes to the ordering of plants into a secure system of classification.

Or so it has long been thought. But what we now take as axiomatic, like all axioms, has its history.

My aim here is to consider one chapter in this history and its implications. The difficulty outlined by Pliny was taken up again, and charmingly expanded, by the author of the very first of the great illustrated sixteenth-century herbals, Otto Brunfels, in his *Contrafayt Kreüterbuch* of 1532.⁶ Brunfels does this in the splendidly robust fashion by which he aimed to reach the common reader (and not only the more learned students of the fancy but unreliable textbooks by or based on the ancient authorities):

Dieweil aber solichs mügsam gesein die kreüter mit iren fyer alteren zu beschreiben, unnd dazu mal der Truck noch nit gesein, hat solichs kein bestandt mogen haben. Dann gleich wie die menschen ire glidmass, ire eygenen complexionen, ire eygene alter habent, also die kyndheit, yugent, mannschafft, und alter, also auch die kreüter, welche sich auch der mass von eyner zeyt in die andere verwandelen, unnd ynen selb gar nicht gleich noch ähnlich seind, bringt desshalb grossz yrrthumb, das wir vil kreüter in irer jugent kennen, die uns im alter entwachsen, und unbekannt und so auch widerumb. Die kindheyt nenne ich wann sye erstlich uffgan in den Meyen. Die jugent wann sye blüen. Mannheyt wann sye anfahen sich besomen.⁷ Alter wann sye im abnemen seind.

Unnd diese dinge verlauffen sich alle in fyer monaten. Solich alter der kreuter war zu nennen wer wol ein kostlich ding, ist aber mügsam unnd müsst man yedes kraut wol fyermal contrafeyen, möcht mit der zeyt mit unserm kreüterbuch sich zutragen. ...'⁸

Thus, according to Brunfels, it was difficult for the three great Greek botanists to describe the plants in each of their four ages – particularly since there was no such thing as printing in those days. Plants can be compared with humans, Brunfels noted, in that they too pass through the four stages of life, namely infancy, youth, maturity, and old age. This is a source of confusion and error, since the same plant has a different appearance at different stages of its life. A plant that we learn to know in its youth is a very different thing from one in its maturity; and vice versa. Correctly to identify the stage of a plant's life is a precious thing, and requires one – in principle – to portray each plant four times over.

The transformation of the problem that plants change with age and according to season into one of identification and naming could not have been more explicit – '*solich alter der kreuter war zu nennen wer wol ein kostlich ding*' – and the solution was too difficult. What was the painter then to do? As Brunfels himself went on to acknowledge, it would be far too cumbersome to represent each plant four times over – as if even four times were enough; the number was self-evidently arbitrary, determined only by the number of seasons and the supposed stages of life.

For the rest of the century – at least – the issue remained a critical one. In his 1540 *Botanomethodus*, Carlo Figulo acknowledged the core difficulty (and as with all the *methodi* of the sixteenth century the name betokens an attempt, let us not say at making a science, but rather at arriving at a more rigorous and systematic way of ordering the multiplicity of nature): 'No one can know any plant perfectly unless he attends to it at the three aforementioned times. For the image of a budding plant is one thing, a flourishing and vigorous specimen [*species!*] another. Still another is the idea of one that is withering and declining. ...'⁹ This is the problem with which the century would continue to struggle.

The next two great protagonists in the history of the illustrated herbal, Leonhart Fuchs and Hieronymus Bock, showed the same preoccupation with the relation between colour, taxonomy, and classification.¹⁰ Both Fuchs's *De historia stirpium* of 1542¹¹ and Bock's *Kreuter Buch* of 1546 and 1551¹² contain prefatory matter in which painted illustrations are justified at length, despite the problem identified by Pliny and despite Galen's insistence that pictures are actually an obstacle to the study of plants. One could perhaps argue that there was no problem, since these early herbals were specifically illustrated in black and white by woodcuts (though these, of course, were quite frequently coloured). But black and white was no solution for those who realized, as Figulo did, that some account had in any case to be taken of the colour

changes endured by plants over the course of a day, a year, or a lifetime. What is perhaps most significant about the way in which these early herbalists refer to their illustrations is that they not only use terms for the portrayal of plants such as '*contrafey[t]en*' (as one might indeed expect, a term for the conveying of individual and specific features), but also '*malen*' and even – when writing in Latin – '*pictura*', to refer quite specifically to illustrations in black and white, such as those prepared by Hans Weiditz (for Brunfels), David Kandel (for Bock) and the famous trio of Heinrich Füllmaurer, Albrecht Meyer and Veit Rudolf Specklin (for Fuchs).

The distinction, in Fuchs, between the artist who drew the plant (generally from the life), the one who transferred it to the block, and the one who actually cut the block is, of course, an important one in the history of art and has been much commented upon; but less attention seems to have been paid to the way Fuchs himself conceived of the role of his illustrations in the transmission and organization of botanical knowledge. Of all the illustrations in the herbals, those commissioned by Fuchs have long been regarded as conveying more of the essence of the plant than those of the other illustrators. As one of the great modern botanists and historians of botany, Agnes Arber, put it: 'the drawing which is ideal from the standpoint of systematic botany, avoids the accidental peculiarities of any individual specimen, seeking rather to portray the characters fully typical for the species.'¹³ She was sure that these woodcuts represented 'the high-water mark of that type of botanical drawing which seeks to express the individual character and habit of each species, treating the plant broadly as a whole'.¹⁴ Certainly one could say that these criteria were more successfully met by the accurate drawings of Fuchs's draughtsman Albrecht Meyer and the spare, unhatched and unshaded line of his engraver Veit Rudolf Specklin¹⁵ than by the technically and pictorially more subtle work – notably more subtly shaded – of Hans Weiditz (in Brunfels's herbals), or by David Kandel's charming anecdotal illustrations for the robust works of Hieronymus Bock, where the plants are set in their natural environment or in the company of animals and people.

Fuchs's own assessment of his aims and achievement provides explicit justification of Arber's view of his illustrations. In the foreword to his book, Fuchs mounted a most vigorous defence of the importance of *picturae* or *imagines* (the terms are used interchangeably) as a means of studying and learning to identify even the humblest plant. In direct opposition to the line that Linnaeus would later take, and in keeping with the classical and Renaissance views of the superiority of sight over sound, Fuchs emphasized that he had added pictures to his work for no other reason than that *pictura* expressed each specimen more securely and fixed it more deeply in the mind than mere words.¹⁶ But this faith in pictures, as we have seen, was not without its own problems.

Despite the emphasis on '*artificiosae imagines*', Fuchs fully realized the importance of recognizing the distinctive *notae* of each plant. One had, after all, to be sure that one could name it properly and establish, where possible, the correlation with an equivalent plant in Dioscorides; and this was endangered if one allowed what was distinctive to be obscured by art. So immediately prior to a lengthy (and conventional) *laus* of Specklin and of *pictura* itself, he announced the need for restraining the art of *pictura*:

And with regard to the pictures themselves, which are securely expressed according to the outlines (*lineamenta*) and appearance (*effigies*) of each living plant, we have taken particular care that they should be most perfect, and in such a way that each plant is painted with its roots, its stalks, leaves, flowers, seeds and fruits ... and we have paid careful attention that the shading, and other less crucial things, with which painters sometimes strive for artistic glory, should not obliterate the basic form of the plants; and we have not allowed the artists thus to indulge their whims, in such a way as to make the pictures correspond less to the truth.¹⁷

The year after the publication of Fuchs's *De historia stirpium*, Vesalius's great *De humani corporis fabrica* appeared. In the prefatory letter to his printer Johannes Oporinus (which merits attention if only for its unprecedented devotion to the technical and aesthetic problems of typesetting and printed illustration), Vesalius displays a concern about an almost identical tension arising from the aesthetic use of shading. He does so in revealing terms:

For signs [*notae*] with which to designate the parts in any delineation [*delineatio*], we have carved on the plates characters of the sort constantly employed in printing shops; first we used upper-case Latin letters, and then, lower-case; thereafter lower-case Greek and then some upper-case, which are not identical with the Latin ones; but since all of these did not suffice, we used numerals and any other indicative signs that were available in ordinary types ... Special care should be employed in the printing of the plates ... I desire above all that in the printing you copy as closely as possible the proof struck off by the engraver as a specimen (which you will find enclosed together with the woodblocks); for thus no character, however much obscured in the shading, will lie hidden from the careful and observant reader. Likewise take care of what I consider most artistic and so pleasing to look at in these pictures [*pictura*], so that the thickness of the lines in certain parts be combined with the elegant gradation of the shadows [*eleganti umbrarum obfuscatione!*].¹⁸

It will be noted that in this passage Vesalius uses the term *pictura* to refer to the illustration when it is thought of in the context of art; but for the rest, here as in the *Tabulae sex* of 1538 and elsewhere, the constant term he uses to refer to the illustration of parts of the body is *delineatio* or *lineamenta*. With this step, the relationship between the absence of colour and the use of drawing to achieve the essential parts of things

instantly becomes clear. Drawing, even outlines deprived of shade – the *lineamenta* – replaces colour as the chief medium by which to convey the essence of living objects. Colour, shade, and artifice are nothing less than obstacles to the clear identification of the characteristics of things. It is by no means irrelevant to note that while coloured copies of the great herbals are very common indeed, it is almost impossible to find a coloured Vesalius. But then one could argue that in none of the herbals – unlike the books of the great classifiers, from Cesalpino through Gaspar Bauhin to Tournefort and Linnaeus – was classification, specifically, an overt concern. Nomenclature, however, most certainly was – and here pictures could aid in identification of particular species, even though they might not provide the kind of essential information necessary for classification by group.

The fact is that despite the efforts of Cesalpino in his *De Plantis* of 1583 to establish a secure classification of plants on the basis of certain parts (rather than on their mutable external characteristics), the dilemma over colour persisted in every domain, both scientific and artistic. When Dolce wrote his dialogue on colours in 1565, he could give a perfectly reasonable account (super-concise and oversimplified though it may have been) of the competing ancient views regarding colour, in which its non-essential (or secondary) status still seemed paramount (despite the views of Aristotle):

The Pythagoreans believed that colour was none other than surface. But Plato in the *Timaeus* said that it was light. It is true that Aristotle, keeping to the middle way, thought that colour was the boundary of the body, not of that part by which the body is contained, which would be its surface (as the Pythagoreans have it); but rather luminosity, which is without boundary; and that would be light, as Plato thought.¹⁹

And yet Dolce himself believed that there were indeed colours in '*cose miste*' (mixed things), such as animals, plants and metals. No wonder that his protagonist, Cornelio, rather tiredly concluded this section of the work with the words, 'I do not wish to proceed so philosophically, investigating every minute detail' (*io non voglio proceder tanto filosoficamente ricercando ogni minutezza*), before proceeding to his minute analysis of the pictorial and symbolic aspects of individual colours themselves.

For Ulisse Aldrovandi (1522–1605), that extraordinarily omnivorous collector of antiquarian and natural historical information of the late sixteenth century, who provided the leadership and inspiration for much of the collecting activities of natural historians in Italy for some time to come, there was little uncertainty about the role of colour. For him, colour was 'an excellent scale, and a very sure means, which when joined together with the other accidents – that is, smell, taste and feel – allow one to arrive at the most perfect knowledge of mixed things, whether perfect or imperfect'.²⁰ But then Aldrovandi's classifications, as even Foucault was aware, were based on notoriously promiscuous and fluid criteria.²¹

Aldrovandi's position on colour seems to have been exactly the one adopted, at least in their natural historical researches into plants and animals, by that great band of Italian natural scientists and philosophers, the Accademia dei Lincei, whose attempt to embrace all the world of nature, of art and of knowledge, follows naturally in the wake of their predecessor from Bologna.

Nevertheless, I am sending you herewith some seeds of a plant which I have never seen before, which I found in a very deep cave, in a deserted spot in the mountains of Spoleto. And this plant is not at all dissimilar to the common melon, except that it has leaves which are more deeply textured and a different flower. This is sometimes yellow and sometimes white; it has fruits some of which are long, others round, and others squashed. At first the colour of some of them is dark green, then they become even golder than gold, and give so pleasing and sweet an odour that their fragrance can fill any large room. They are so beautiful to the eyes, so pleasing to the nose, and so satisfy the mind that it is an incredible thing.²²

Thus wrote Johannes Eck to Federico Cesi in the summer of 1603. Eck was one of the four devoted, energetic and talented young men who in August 1603 together formed the Accademia dei Lincei.²³ He was probably the closest of them all to their eighteen-year-old leader Cesi, and this letter is almost certainly the earliest in the great *carteggio* that documents the researches, the travails and vicissitudes of that brave group.²⁴ Soon he would be expelled from Italy as a result of the hostile scheming of Federico's father, and then he went mad; but it was really he, rather than Francesco Stelluti (who later became Cesi's closest collaborator and friend) and Anastasio de Filiis, who shared in the two great passions, astronomy and botany, of these early researches of the Lincei.

In Eck's letter the stress on the subjective qualities of the melon is remarkable. He could hardly have laid greater emphasis on colour, and then on smell and touch. Even if he believed that these qualities inhered in the object of examination itself, Eck constantly harped on the fact that the colours are pleasing *to the eyes*, the smell *to the nose*. By referring to its appearance at different times, and (implicitly) under different conditions, Eck may have hoped to cover all bases, as it were. In other words, he may have felt that as full as possible a listing of the subjective qualities of the plant would ensure its identification in whatever form it might be found, and at whatever stage of its existence. But was there not a more economical way of going about the business of identifying a new plant – to say nothing of classifying it, as we know Cesi would have wanted to do? And was it really necessary to have a drawing made of every specimen the Lynxes found, as they ideally wanted to do (indeed it may well be a record of Eck's melon that is preserved in the splendidly coloured illustration that survives amongst the great corpus of Lincean drawings at Windsor Castle)?²⁵

One of the great and still insufficiently remarked problems in the history of the

so-called scientific revolution of the seventeenth century is not so much the tension between empirical and experimental science on the one hand and theoretical science on the other, but rather the still unregarded evidence for the empirical researches of the closest supporters of Galileo. Had Alexandre Koyré and Michel Foucault known about these, and about the great mass of drawings that survives in Windsor and in Paris, done with the unaided eye *and* with the microscope,²⁶ they would probably have written differently about this chapter in the history of culture. Had he been aware of the extraordinary range of observational and *in situ* investigations conducted by the Lynxes, Koyré would have been less dismissive of the role of common sense even in the birth of modern physics (one has only to recall Galileo's many discussions with the Lynxes about stones and other natural objects which give off light of their own), while Foucault would certainly have wanted to shift the beginnings of his new episteme away from classical France and Descartes to Italy. It has only been in the last decade that the evidence for all these researches has come to the fore; and they were conducted by some of Galileo's closest supporters and followers. Not only was Galileo invited to become the fifth Lynx (after the aged Giovanni Battista della Porta, in whom so much of the old forms and modes of science came to the fore); he accepted their invitation gratefully and proudly, and participated fully in discussions not only about his own physical and theoretical researches, but also about their more purely empirical ones. On the roster of Lynxes, Galileo was followed by a string of distinguished plant experts (especially experts in simples), including Rubens's old friend Johann Faber from Bamberg, Johannes Schreck (called Terrentius) from Konstanz, Theophilus Müller (Molitor) from Ingolstadt, Fabio Colonna from Naples and finally the famous antiquarian and *erudito* Cassiano dal Pozzo from Rome, who presented a book on the natural history of birds as his entry piece to the Lincei in 1622.²⁷

But there is a paradox in all this. It is brought to the fore by the passage from Eck. He notes that the flowers of his 'melon' are now yellow and now white; the fruits are first dark green, then they become golden; and so on. Even though Eck certainly displays some awareness of the subjectivity of sensual impressions,²⁸ the mutability he describes is precisely the difficulty that faces anyone who attempts to name and classify a species – especially but not exclusively in the world of plants. Yet this difficulty does not seem to have been fully grasped by Eck or by any other of the great Lincean botanists, from Cesi himself through Schreck, Faber, Müller and even Fabio Colonna; and not at all by Cassiano in that one scientific area in which he made himself expert, ornithology. As has been observed of his manuscript ornithological descriptions, colour was perhaps the most important descriptive criterion for Cassiano. His writings are striking not only for the regularity with which colour is mentioned, but also for the characteristically 'living' colours applied: use of a colour

such as black or white will be qualified so that we know exactly what sort of white or black it was. ... Colour is a means of distinguishing both between different species of bird, and between different sexes of the same bird.²⁹

Cassiano's treatises – all in manuscript – contain remarkably close and lengthy descriptions of the colour of the white pelican, the greenfinch, the blackbird, the beak of a vulture, the bill of a toucan, and the iridescent colour of hummingbirds.³⁰ For example, he notes of the iris of the bearded vulture that 'its circumference is of the most lovely colour, tinged at its extremity with the finest lead red, or the colour of the flowers of the pomegranate, and then becoming the kind of yellow that resembles that of the skins of the chamois. ...'³¹ But Cassiano's persistent use of colour as a means of distinguishing between sexes suggests that description with colours in ornithology presented a similar problem to that of botany. Colour might reveal a difference in gender but it might at the same time hamper the determination of species: *might*. It is nevertheless true that birds raise a classificatory problem of a different order – certainly of a greater magnitude – than that of plants. Were Cassiano and his colleagues aware – as the great late eighteenth- and early nineteenth-century zoologists certainly were – of the fundamental difference between the practical classification of plants and animals? In the case of plants, after all, it was easier to discern unchanging features as the basis for the discrimination of categories than in the case of birds, where the identification of such parts was much less clear and where there were many more possible parts, apparently, to choose from. It seems unlikely, lacking the principle, that the Lincei would have proceeded, even distantly, on the basis of such a distinction.

In any event, it was Cesi who, in the prime of his short life, spent his energies in an attempt at a universal classification of the natural world.³² Did not he or any of his colleagues realize the extent to which judgements of colour hampered rather than assisted the drive towards what they themselves would have regarded as a natural classification? Did they not recognize the degree to which colours were non-essential, mutable, secondary, and possibly entirely subjective?

It seems not. One might have thought that the use of the newly discovered telescope and microscope – named by Cesi and lauded by Faber in two of the most moving passages in the history of scientific technology³³ – would either lessen or at least subvert the status of colour as a discriminatory criterion of a class; but this does not appear to have been the case at all. Certainly the use of both instruments does not diminish the importance of the visual as the basis of empirical research: but even in its primitive forms the microscope offered the possibility of a renunciation of colour and picture in favour of shape and form, dispossessed, it might have seemed, of the shadows and other 'artificial' devices described by Fuchs and Vesalius in 1542–3.

When Giovanni Battista Ferrari³⁴ – who moved constantly on the periphery of the Lincean orbit – made his microscopic examination of hibiscus seeds (upon which the first botanical illustrations to be made with the aid of a microscope were based),³⁵ he realized the necessity of counting as an aid to examination by touch and by colour.³⁶ In this respect he perfectly exemplifies Foucault's insistence on *mathesis* as a crucial part of the new 'classical' episteme. But the rest of the 1633 *De florum cultura*³⁷ is distinguished by a taxonomical and classificatory effort that is consistently hampered by Ferrari's determined colouristic descriptions. The even more rigorous classificatory divisions of his 1646 book on citrus fruit, *Hesperides sive de malorum aureorum cultura*, renounced colouristic description even *less*.³⁸ But by then it was an old-fashioned work; after all, Ray and Tournefort were not a long way off.

1633, of course, was the year of Galileo's trial; and it is to him that this discussion must now turn. The irony – and it is a striking one – of the constant Lincean reliance on the empirical evidence of colour as an aid to classification and the ordering of the multiplicity of natural things is that the Lincei were the very people without whose active support and help Galileo's *Saggiatore* of 1623 would never have been published. From around 1619 right through to 1623 Faber and Cassiano, along with those two other Lincean prodigies, Giovanni Ciampoli and Virginio Cesarini, worked intensely in Cesi's homes in Acquasparta and Rome on Galileo's manuscript. Galileo owed the editing and the eventual publication of his seminal work entirely to them.³⁹ And they, like Cesi, in constant touch with a frequently discouraged Galileo in these years, must have been perfectly aware of one of the clearest possible statements ever made about the scientific status of colour, and of all those other qualities that depended not on the objective mathematically definable properties of mass, space, extension, and number (more problematically), but on the subjectivity of the subject:

I say that whenever I conceive of any material or corporeal substance, I am compelled of necessity to think that it is limited and shaped in this or that fashion, that it is large or small in regard to other things, that it is in this or that place, at this or that time, that it moves or is immobile, that it touches or does not touch another body, that it is one, a few or many; nor can I by any stretch of the imagination separate it from these conditions. But that it is white or red, bitter or sweet, sounding or mute, of pleasant or unpleasant odour, I do not feel compelled in my mind to conceive it as necessarily accompanied by such conditions. On the contrary, if we were not assisted by our senses, reasoning and imagination would never apprehend these qualities. Therefore I think that tastes, odours, colours and so on ... are nothing but pure names, and reside only in the feeling body, so that if the animal is removed, all these qualities are taken away and annihilated.⁴⁰

Every one of the Lincean botanists and zoologists must have known this passage and

grasped its implications; and yet they continued to proceed almost exactly along the lines articulated by Aldrovandi. It is true that they also took primary properties into account in assessing the new species constantly discovered by or sent to them; but at no stage was colour anything like as suspect as it so clearly was in the *Saggiatore* – not even years later.

But Galileo had established for all time the modern philosophical distinction between primary and secondary qualities; and when we consider the activities of the Lincei and the ultimate failure of their classificatory efforts, one realizes that the assignment (and acceptance) of the non-essential status of colour has been wholly responsible for the relegation of its role in both taxonomy and classification. The distinction between primary and secondary qualities, between those qualities that are inherent and fundamental properties of matter on the one hand and those that, being sensory, depend wholly on the existence of the external subject, was clearly taken up by Robert Boyle ('the perceptions of these impressions [of external objects] are by men called by several names, as *heat, colour, sound, odour* ... If we should conceive all the rest of the universe to be annihilated, except any of these entire and undivided corpuscles ... it is hard to say what could be attributed to them besides matter, motion (or rest), bulk, and shape');⁴¹ but the classic statement of this position after Galileo, and the classic formulation of the distinction between primary and secondary qualities, are, of course, to be found in Book 2 of John Locke's 1690 *Essay on Human Understanding*.

Secondary qualities. Such qualities, which in truth are nothing in the objects themselves, but powers to produce various sensations in us by their primary qualities, i.e. by the bulk, figure, texture, and motion of their insensible parts, as colours, sounds, tastes, etc., these I call *secondary qualities* ... The particular Bulk, Number, Figure, and Motion of the parts of Fire or Snow, are really in them, whether anyone's senses perceive them or not: and therefore they may be called real qualities, because they really exist in those bodies. But light, heat, whiteness, or coldness, are no more really in them, than sickness or pain is in manna. Take away the sensation of them; let not the eyes see light, or colours, nor the ears hear sounds; let the palate not taste, nor the nose smell, and all colours, tastes, odours, and sounds, as they are such particular ideas, vanish and cease, and are reduced to their causes, i.e. bulk, figure, and motion of parts.⁴²

Although some botanical handbooks would continue to be illustrated, and while the colouring of prints – which reaches its greatest heights in the coloured editions of the Surinamese work of Maria Sibylla Merian, first published in 1705 – for some time went hand in hand with the development of the watercolour illustrator's art, from now on colour was pretty much finished as a classificatory criterion. All that remained was for Linnaeus to take away the rest of visual presentation as well. For him, only

language offered an adequate form for the presentation of the essence of things. But the vehemence of his tirade against visual representation in the *Ratio operis* of the *Genera plantarum* almost takes the breath away.

I do not recommend the use of images for the determination of genera. I absolutely reject them – although I confess that they are more pleasing to children and to those who have more of a head than a brain. I admit that they offer something to the illiterate. Before people became accustomed to the use of letters, it was necessary for everything to be expressed by pictures, where the sound of the mouth could not be present. But the invention of writing provides an easier and more certain way of communicating ideas. So even in botanical matters before the discovery of letters, these figures were of the greatest help; but once [letters were] to hand, one could follow a much shorter road: we have twenty-six letters with which to write our ideas.⁴³

So much for the old idea of paintings as the books of the illiterate. Botany, after all, was a *science*; one could leave art to children, to the illiterate, and to primitives (with whom one could generally align those who went in for the aesthetic pleasures of pictures). Letters were better for science because they were more advanced; hence – as part of the argument – the standard eighteenth-century appeal to a primitive state before letters. Linnaeus goes on:

(α) Who ever derived a firm argument from a picture? But one can easily do so from written words.

(β) If I want to use and take account of the character of a genus in a work, I am not always conveniently able to paint, engrave, print, or reproduce a picture; a description is very easy.

(γ) If the parts differ in the same genus, as in many, and as they do by number and by appearance in distinct species, I would still try to convey the location and proportion of the parts. I can in no way express this in an image, unless I gave an equal number of figures. If therefore there were 50 species and the same number of differences, I would have to provide the same number of pictures. Who could ever derive any certainty from such a large number?⁴⁴

A new twist to an old argument! The herbalists may have worried about having to represent plants four times over – say; but here Linnaeus not only points to the problem of a far greater number of representations, but also to the impossibility of ever arriving at specificational certitude on the basis of *quite* so many pictures. And he concludes with patent sarcasm: ‘And so we shall try to express all the characters [*notae*] equally clearly by means of words, and maybe even more clearly than the others with their splendid pictures.’⁴⁵

If one thinks back to the sixteenth-century herbalists and compares their approach with Linnaeus’s third argument, then one realizes that it is here that the failure of

colour is finally transformed into the failure of art – or rather of visual representation in general and art in particular. Although it is true that ancient natural historical and medical writers like Pliny and Galen had recommended words over pictures as a more adequate and accurate means of conveying natural historical information, none had turned it into so vigorous an attack on pictures in particular and art in general. In these passages from Linnaeus lie the roots of one of the great modern paradigms, that of the transformation of general semiosis into a model in which words are the essential bearers of the meaning of things. Gombrich no less than Barthes or Foucault is heir to this tradition. In his commitment to the theories of Karl Popper, Gombrich takes a similar view of the failure of art. It is ambiguous, so it cannot serve ‘science’. Words – or rather propositional statements – do that. One might say that to call this the ‘failure’ of art is absurd: art has its successes in domains beyond and outside science (or so the argument would run). But the matter is not so simple.

There is a cheap and superficial way of looking at *Art and Illusion* that involves claiming that it reduces art to illusion and to schema; but the argument of the book is profoundly more complex than this. In Gombrich’s view, as everyone knows, classification and schema go together in the making of art. What this position also seems to entail, as is clear from the Ivins review, is a view of science that is wholly propositional (and therefore divorced from art – ‘too ambiguous’ – or visual representation in general). This, furthermore, is a position that goes hand in hand with a resistance to induction as the basis for scientific ‘progress’ – since induction always leaves space for untestable doubt. That is, it resists the operation of the processes of falsification that are necessary, in the Popperian-Gombrichian view, to the hypothetical basis of conceptual and classificatory thought. But colour and art go with induction in their lack of finality. They are always provisional, and dubious; but they also offer a parallel for the open-endedness and multiplicity of things. Now this open-endedness can be reduced to order by the use of diagrams of a Euclidean kind, or illustrated by non-Euclidean means and fractals.

In either case the question remains: since the diagram that classifies is so clearly a visual thing, what *then* happens to the status of art? How far is it to be allowed to move in the direction of science? After all, Gombrich insists repeatedly on the identity of the role of hypothesis in the processes and discoveries both of art and of science. What more precisely is it, in the Gombrichian view, that arises from the processes of schematization and classification which Gombrich might have associated with ‘making’ and ‘matching’, but, because of the necessity of his theory, could not? This, of course, is one of the great tensions in *Art and Illusion* and in much of the rest of Gombrich’s great writings. And colour exemplifies the problem. In taking what might be described as a post-modern – certainly a post-Kuhnian – view of things, Wolf

Lepenius raised the issue of the classification of birds in the context not of early seventeenth-century but of eighteenth-century ideas about classification. In doing so he alluded to the problem not so much of the ambiguity of art, as of the ambiguity and inspecificity of words. As Cassiano and his colleagues might well have foreseen (though it is very unlikely that they did), colour could even assist in classification when propositional (and therefore linguistic) definition was inadequate to basic tasks of description, and too imprecise and circumlocutory for it. With the multiplication of species of birds as a result of increasing knowledge of what was found in foreign and strange places,

The combination into genera thereby became unavoidable ... The great difficulties presented by a Natural History of Birds again became especially clear from their mode of representation. Since the painting of colours by means of mere words caused particular difficulty, coloured engravings of birds were now prepared, while black and white was sufficient for the quadrupeds. Obviously, because of the expense involved, one could not have coloured plates in all copies of the *Histoire naturelle des oiseaux* ... [but] Buffon's characterization of coloured plates as a kind of bad painting, a *genre de mauvaise peinture*, is testimony to the fact that he only used them reluctantly, since they were contrary to his usual method of representation in his Natural History. For the rest, the coloured plates were engraved after birds to hand in the Cabinet National, which already showed substantial colour variations. This was the occasion for Le Vaillant's judgement, in his *Oiseaux d'Afrique*, that the prints were 'so defective and so little in accord with nature'.⁴⁶

The problem was still not resolved.

When, in the same year as Vesalius's *De humani corporis fabrica*, Peter Ramus published his *Dialecticae institutiones* and his *Aristotelicae animadversiones*, he brought to a head a tendency that had been growing for some time, namely to take the colour out of rhetoric in the interest of logic. By the colour of rhetoric one intends, of course, those traditional aesthetic tricks and tropes that were known as the colours. As Walter Ong has pointed out so insistently over the years, the Ramist diagrams are in fact spatial and visual phenomena, not purely linguistic ones by any means.⁴⁷ Gombrich, in so many respects the essential Kantian, thought in some places that the removal of colour (and therefore the failure of art) entailed the logic of the proposition. But still he could not take the idea of the schema and make it complicit in this expulsion of art from the camp of science; he left it there, and the interest of art remained too. In this Gombrich was no Kantian at all. The result is certainly inconsistent and less rigorous, perhaps, than its Kantian forebear; but for all their inconsistency – indeed, precisely *because* of it – Gombrich's works together constitute the most humane writings we have, even when inexplicit, on the subject of the relations between the modernist view of science and the history of art.

Notes

- 1 William H. Ivins, Jr., *Prints and Visual Communication* (London, 1953).
- 2 E.H. Gombrich in *The British Journal for the Philosophy of Science*, 5 (1954), pp. 168-9.
- 3 The only way to make reasonably clear sense of this passage – which in this form is in fact closer to the sixteenth- and seventeenth-century versions than many modern ones – is to take into account what W.H.S. Jones in his Loeb edition (1966), p. 140, note a, called ‘Pliny’s “journalise” style of writing’.
- 4 Cf. J.P. Richter, ed., *The Notebooks of Leonardo*, fragments 264 (‘La superfitie d’ogni opaco [corpo; cf. frag. 269] participa del colore del suo obietto’), 267 (‘Ogni parte della superfitie, che circunda i corpi, si trasmuta in parte del colore di quella cosa che gl’e posta’), 268 (‘La superfitie d’ogni corpo opaco participa del colore del suo obietto. Ma con tanta maggiore o minore impressione quanto esso obietto sia più vicino o remoto o di maggiore o minore potentia’), and the significant passage in frag. 265 (‘Il simulacro inpreso nello spechio participa del colore del predetto specchio’). This view is repeated many times throughout the manuscripts. See also the interesting piece by James S. Ackerman, ‘On Early Renaissance Color Theory and Practice’, in *Studies in Art History: American Academy in Rome*, I (1980), pp. 11-38, reprinted in: *Distance Points. Essays in Theory and Renaissance Art and Architecture* (Cambridge and London, 1991), pp. 151-84.
- 5 For the philosophical and psychological problem of natural kinds, see the good overview and references in Frank C. Keil, *Concepts, Kinds, and Cognitive Development* (Cambridge and London, 1989), especially chapters 3 and 9.
- 6 Otto Brunfels, *Contrafayt Kreüterbuch ...* (Strasbourg, 1532; the first Latin version, *Herbarum vivae icones ...*, had already appeared with Schotten in 1534).
- 7 Presumably for *besamen*, as in the very rare 1534 octavo edition of Brunfels’s work, published as the *Kreüterbuch Contrafayt* (Strasbourg, 1534), fol. c vi verso.
- 8 Brunfels, 1532, fol. b iv verso.
- 9 ‘Nemo enim potest perfecte noscere herbam quamquam nisi tribus temporibus eam praedictis illi asiterit. Alia enim est imago herbae pullulantis. Alia est species florentis & vigenis. Alia est idea decrescentis & marcescentis ...’, *Dialogus qui inscribitur botano methodus, sive herbarum methodus* (Cologne, MDXI [presumably for MDXL]), fol. C iii recto.
- 10 I hope elsewhere to deal more closely with the issue of the relations between classification and taxonomy; but this is not the place to do so, except allusively.
- 11 Leonhart Fuchs[ius], *De historia stirpium ...* (Basle, 1542 appearing as the *New Kreüterbuch* in the following year).
- 12 Hieronymus Bock (Tragus), *Kreuter Buch* (Strasbourg, 1546 and 1551). The unillustrated though revealingly entitled *New Kreüterbuch von underscheydt, wirckung und namen ...* had already appeared in Strasbourg in 1539, however.
- 13 Agnes Arber, *Herbals. Their Origin and Evolution. A Chapter in the History of Botany, 1470-1670*, 3rd edn., with an introduction and annotations by William T. Stearn (Cambridge, 1986 (first edn. 1912)), p. 206.
- 14 *Ibid.*, p. 212.
- 15 Both artists were portrayed along with the man who transferred the designs from the block to the plate, Heinrich Füllmaurer, in the famous – and very attractive – plate showing the three of them together in the *De historia stirpium*. Of course, in this as in all such cases, it is not easy to establish who – if anyone in particular – was particularly responsible for the way the woodcut illustrations actually look.
- 16 ‘... idque nulla alia de causa, quam ut ea quae nudis verbis exponit historia, certius exprimeret, atque adeo altius animo infingeret pictura’, Fuchs, 1542 (as in n. 11), fol. 6r.
- 17 ‘Quod ad picturas ipsas attinet, quae certe singulae ad vivarum stirpium lineamenta & effigies expressae sunt, unice curavimus ut essent absolutissimae, atque adeo ut quaevis stirps suis pingeretur radicibus, caulibus, foliis, floribus, seminibus ac fructibus, summam adhibuimus diligentiam. ... De industria vero & data opera cavimus ne umbris, aliisque minus necessariis, quibus interdum artis gloriam affectant pictores, nativa herbarum forma oblietaretur: neque passi sumus ut sic libidini suae indulgerent artifices, ut minus subinde veritati pictura responderet’, Fuchs, 1542 (as in n. 11), fol. 7v.
- 18 ‘Notarum enim, quibus partes in delineatione quapiam insigniendae fuerunt, loco, characteres, quorum in officinis perpetuo usus est, in tabulis

sculpsimus: primum fere a maiusculis, & dein alijs Latinorum orsi: insuper Gaecorum minoribus: mox ab eorundem grandioribus qui Latinis non sunt familiares: quum vero hi omnes non sufficerent, numerum typos assumpsimus, & si quae alia notula in communibus typis occurrebat. ... Praecipuum studium in tabularum impressione erit impendendum, ... Hoc unum percuperem, ut inter excudendum id exemplar quam proxime imitareris, quod a sculptore speciminis sui loco impressum, una cum ligneis formis reclusum invenies. Ita enim nullus character, quantumvis etiam in umbra reconditus, oculatum sedulumque lectorem laetabit. & quod in hac pictura longe est artificiosissimum mihiq; spectatu perquam iucundum, linearum in quibusdam partibus crassities simul cum eleganti umbrarum obfuscatione apparebit', *Andrea Vesalii ... De humani corporis fabrica* (Basle, 1543), sig. 5. This translation is slightly adapted from that given by J.B. de C.M. Saunders and J. O'Malley in their edition of 1950 (The World Publishing Company and much reprinted by Dover).

19 Lodovico Dolce, *Dialogo nel quale si ragiona della qualità, diversità, e proprietà dei colori* (Venice, 1565), fol. 7: 'I Pithagorici credettero il colore altro non esser che superficie. Ma Platone nel suo Timeo disse, lui esser lume. Egli è vero, che Aristotele tenendo una strada di mezzo stimò, che 'l colore fosse termino di corpo, non di quella parte, da cui è contenuto esso corpo, che questo sarebbe superficie: come vogliono i Pithagorici: ma della lucidezza, ne però non terminata; che ciò sarebbe lume, come piacque a Platone.'

20 'un'ottima scala, et mezzo sicurissimo congiunto con gl'altri accidenti cioè odore, sapore, et tatto per venir in cognitione perfettissima de' misti o siano perfetti o imperfetti' (Biblioteca Universitaria, Bologna, MS. Aldrovandi 6, vol. I, fol. 35v; cited by Giuseppe Olmi, *L'Inventario del mondo. Catalogazione della natura e luoghi del sapere nella prima età moderna* (Bologna, 1992), p. 368, no. 205).

21 On these, see, for example, the nice summary in William B. Ashworth, Jr., 'Natural History and the Emblematic World View', in *Reappraisals of the Scientific Revolution*, ed. David C. Lindberg and Robert S. Westman (Cambridge and New York, 1990), pp. 304-32, especially pp. 313-16.

22 [G. Gabrieli], *Il Carteggio Linceo*, in: *Atti della Reale Accademia Nazionale dei Lincei, Memorie della Classe de*

Scienze Morali, Storiche e Filologiche, ser. 6, vol. VII (1938-42), pp. 1-1434, p. 24.

23 The collected works of Giuseppe Gabrieli, most of which are now usefully collected in Giuseppe Gabrieli, *Contributi alla Storia della Accademia dei Lincei*, vols. I-II (Rome, 1989), provide the fullest documentation currently available on the early history of the Accademia dei Lincei, but for a useful summary see my article in the catalogue of the exhibition *The Paper Museum of Cassiano dal Pozzo* (London, 1993), pp. 141-53. The literature on the Accademia dei Lincei has expanded enormously in the last decade or so; useful summaries include *Federico Cesi e i Primi Lincei*, exhibition catalogue, ed. Giovanni Morello (Vatican City, 1986); and *L'Accademia dei Lincei e la cultura europea nel XVII secolo*, exhibition catalogue, ed. Anna Maria Capecchi et al. (Rome, 1992).

24 For the lincean *carteggio*, see no. 22 above.

25 Windsor Castle, Royal Library, inv. no. RL 19384; for the corpus of natural history drawings at Windsor, see the following note.

26 On the Windsor drawings, see now Francis Haskell et al., *Il Museo Cartaceo di Cassiano dal Pozzo. Cassiano naturalista, Quaderni Puteani*, I (Milan, 1989), especially the articles by Freedberg and McBurney, with further references. Much further material available in Francesco Solinas, ed., *Atti del seminario internazionale di studi su Cassiano dal Pozzo. Napoli, 18-19 dicembre, 1987* (Rome, 1987). On the drawings in the Institut de France, see A. Ubrisz, 'Il codice micologico di Federico Cesi', *Rendiconti dell'Accademia Nazionale dei Lincei, Classe Scienze fisiche, matematiche, e naturali*, ser. 8, vol. 67 (1980), pp. 129-34, and Gilberto de Angelis and Paola Lanzara, 'La *Syntaxis plantaria* di Federico Cesi nei codici di Parigi: La nascita della microscopia vegetale', in *Convegno celebrativo del IV centenario della nascita di Federico Cesi. Acquasparta, 7-9 ottobre 1985 (Atti dei Convegni Lincei, 78)* (Rome, 1986), pp. 251-76. An edition of the important mycological codices from Cesi's collection in the Royal Botanical Gardens at Kew is being prepared by Dr David Pegler.

27 Aside from the abundant material collected in Gabrieli (as in n. 23) and the further references in that note, a good overview is provided by my 'Cassiano and the Art of Natural History', in *The Paper Museum* (see n. 23), pp. 141-153. On the case of Cassiano's involvement in and work on

Giovanni Pietro Olina's *Uccelliera* (Rome, 1622), see also Henrietta McBurney, 'Cassiano dal Pozzo as Ornithologist', in *Cassiano dal Pozzo's Paper Museum*, II, *Quaderni Puteani* 3 (Milan, 1992), pp. 3-22.

28 See also Olmi, 1992 (as in n. 20), pp. 368-9 for another view of this tension within the work of the Lincei.

29 Henrietta McBurney, 'Cassiano dal Pozzo as Ornithologist' (as in n. 27), p. 18.

30 For all these, see McBurney, in the article cited in the preceding note, especially pp. 18-20, and her 'Cassiano dal Pozzo as Scientific Commentator', in *Documentary Culture Florence and Rome Grand-Duke Ferdinand to Pope Alexander VII* (Villa Spelman Colloquia, 3), eds. E. Cropper, G. Perini and F. Solinas (Bologna, 1992), especially pp. 355-8. More on Cassiano's use of colouristic description - and of his knowledge of Leonardo and Matteo Zaccolini on the subject of colour - may be found in Janis C. Bell, 'Cassiano dal Pozzo's Copy of the Zaccolini Manuscripts', *Journal of the Warburg and Courtauld Institutes*, 51 (1988), pp. 103-25.

31 My translation of MS. H.319, fol. 209 verso in the Bibliothèque de l'École de Médecine in Montpellier, also cited in McBurney, 'Cassiano as Scientific Commentator' (as in the preceding note), p. 356.

32 Which reached its greatest height in his *Tabulae Phytosophicae*, a fragment of which appeared in the so-called *Tesoro Messicano*, eventually published as the *Rerum medicarum Novae Hispaniae thesaurus seu plantarum animalium mineralium mexicanorum historia ex Francisci Hernandez ...* (Rome, 1651). For the attempt at a *Theatrum totius naturae*, see especially 'L'Orizzonte intellettuale e morale di Federico Cesi, illustrato da un suo zibaldone inedito', Gabrieli, 1989 (as in n. 23) pp. 27-77. In my forthcoming work on the history and theory of classification I deal at greater length with Cesi's contributions in this domain, too much neglected by historians of science.

33 [F. Hernandez], *Rerum medicarum ...*, 1651 (as in preceding note), pp. 461-2 and 473-4; cf. also pp. 537 and 737; see also Gabrieli, 1989 (as in n. 2), pp. 347-71 ('Pratica e tecnica del telescopio e del microscopio presso i primi lincei').

34 On Ferrari see my 'From Hebrew to Gardens to Oranges and Lemons: Giovanni Battista Ferrari and Cassiano dal Pozzo', in Solinas, ed., *Atti*, 1989 (as in n. 26), pp. 27-71, as well as 'Ferrari on the

Classification of Oranges and Lemons', in Cropper, et al., eds., *Documentary Culture*, 1992 (as in n. 30), pp. 287-306.

35 Ioannes Baptista Ferrarius, S.I., *De florum cultura libri IV* (Rome, 1633), pp. 497 and 499; Giovanni Battista Ferrari, *Flora, ovvero cultura di Fiori* (Rome, 1638), pp. 495 and 497.

36 Indeed, colour and texture were not enough. First, 'in order to examine the roughness of the leaves, we were not simply content to feel it with the hand; so we decided to use that type of glass in a tube that makes even the very smallest of bodies look very large and shows each part distinctly, known by its Greek name, microscope' ('Hora per discernere bene quell'asprezza delle foglie non contenti d'haverla sentita con mano, vi habbiamo adoperato quella sorte d'occhiale a cannello, che picciolissimi corpicciuoli fa parere assai grande, e mostra distintamente ogni parte, chiamata col nome greco Microscopio ...'), Giovanni Battista Ferrari, *Flora* (as in preceding note), p. 478. And then, with the aid of the microscope, Ferrari counted 163 seeds divided amongst six compartments in each seed-pod (*ibid.*, p. 493). The phrase 'quella sorte d'occhiale a cannello che picciolissimi corpicciuoli fa parere assai grande' in Ludovico Aureli's lovely translation of the original Latin edition - see the preceding note - is to be set beside Galileo's famous description of a telescope as an instrument that makes 'le cose lontane perfettamente come se fossero state molto vicine'. Cf. also the descriptions of these instruments by Johannes Faber in the *Tesoro Messicano*, as in the references in n. 33.

37 See n. 35.

38 I.B. Ferrarius, *Hesperides, sive de malorum aureorum cultura et usu* (Rome, 1646). See the articles by me referred to in n. 34, as well as 'Cassiano dal Pozzo's Drawings of Citrus Fruits', in *Il Museo Cartaceo di Cassiano dal Pozzo, Cassiano naturalista, Quaderni Puteani*, I (Milan, 1989), pp. 37-47.

39 For a good history of these events, see the detailed pages in Pietro Redondi, *Galileo Eretico* (Turin, 1983), especially pp. 53-60, as well as the more summary account in my 'Van Dyck and Virginio Cesarini: A Contribution to Van Dyck's Roman Sojourn', in *Studies in the History of Art* (Washington, National Gallery of Art, 1993).

40 Galileo, *Il Saggiatore* (Rome, 1623: G. G. Opere, VI, pp. 347-9. For a complex commentary, see also

A.C. Crombie, 'The Primary and the Secondary Qualities in Galileo Galilei's Natural Philosophy', in *Saggi su Galileo Galilei*, ed. C. Maccagni (Florence, 1972), II, pp. 71-91, as well as Alberto Pasquinelli, *Lecture Galileiane* (Bologna, 1968), pp. 110-20.

41 Robert Boyle, 'The origins of forms and qualities according to the corpuscular philosophy', in *Selected Philosophical Papers of Robert Boyle*, ed. M.A. Stewart (Indianapolis, 1991), pp. 51 and 30. For a further discussion of these issues see the useful overview by David R. Hilbert, *Color and Color Perception: A Study in Anthropocentric Realism* (Stanford, 1987).

42 John Locke, *An Essay Concerning Human Understanding*, Bk II, chap. VIII, §10 and §17. Cf. also §9 on primary qualities.

43 'Icones pro determinandis generibus non commendo, sed absolute rejicio, licet fatear has magis gratas esse pueris, iisque qui plus habent capitis cerebri; fateor has idiotis aliquid imponere. Antequam litterarum mortalibus innotuit usus, necessarium fuit omnia picturis exprimere, ubi oris sonus praesens esse non potuit, at inventis his facilius certiorque datur via communicandi idaeas scriptis. Sic etiam in Botanicis ante detectas litteras figurae hae auxilium praebeuerunt sumum; at datis his compendiosiori itur via; nobis sunt litterae viginti sex quibus scribamur nostras idaeas.' Carolus Linnaeus, *Genera plantarum, eorumque characteres naturales ...* (Leyden, 1737), fols. **recto - **verso, §13.

44 (α) 'Ab icone enim quis potest umquam aliquod argumentum firmum desumere, sed a verbis scriptis facillime.

(β) Si generis cujusdam characterem in opere aliquo in usum traherem recenseremque, non possum semper commode iconem depingere, incidere, imprimere, exprimereque, at descriptionem facillime.

(γ) Si in eodem genere, ut in plurimis, different partes, uti numero vel figura inter se in distinctis

speciebus, tenerer tamen tradere partium situm & proportionem. Non possum haec ullo modo exprimere icone, nisi totidem darem figuras. Si itaque 50 esset species & totidem differentes, totidemque deberem tradere picturas; quis ex hisce tam multis ullam certitudinem elicere posset; at in descriptione differentes partes silere, convenientes describere facilius longe est labor, intellectuque facillimum.' *Ibid.*, fol. **verso.

45 'Verbis itaque tentabimus omnes exprimere notas aequae clare, si non clarius, ac alii splendidis suis iconibus.' *Ibid.*, fol. **verso, §14.

46 Wolf Lepenies, *Das Ende der Naturgeschichte* (Munich, 1976), p. 73: 'Die Zusammenfassung zu Arten wird damit unvermeidlich. ... Die grossen Schwierigkeiten, die eine Naturgeschichte der Vögel bietet, werden wiederum an ihrer Darstellungsweise besonders gut sichtbar. Da hier nämlich die Schilderung [!] der Farben durch blosser Worte besondere Mühe macht, werden nun kolorierte Kupferstiche der Vögel angefertigt, während für die vierfüssigen Tier schwarze genügen. Freilich kann die Kolorierung aus Kostengründen nicht in allen Ausgaben der *Histoire naturelle des oiseaux* erfolgen. ... [However!] Buffon's Kennzeichnung der "planches enlumineés" als "genre de mauvaise peinture" zeigt, dass er dieses Hilfsmittel, das den Prinzipien seiner sonstigen Darstellungsweise in der Naturgeschichte widersprach, nur widerwillig benutzt hatte. Im übrigen waren die kolorierte Kupferstiche nach den im Cabinet national vorhandenen Vögeln, die schon erheblichen Farbänderungen aufwiesen, gestochen worden, was Le Vaillant zu dem Urteil veranlasste, die Stiche seien "si defectueuses et si peu conformes à la nature" (*Oiseaux d'Afrique*).'.

47 Walter J. Ong, S.J., *Ramus, Method, and the Decay of Dialogue. From the Art of Discourse to the Art of Reason* (Cambridge, Mass., 1958).